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APPLICANT

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TITLE OF THE INVENTION

~~Auto-Adjustment Video Projector (AAVP)~~

Automated adjustment system for video projectors

CROSS-REFERENCES TO RELATED APPLICATIONS

This application claims the benefits of provisional patent application No 60/158,060, filed October 7, 1999 entitled "Picture to Picture Pointer, White Shadow and Auto Adjustment Projector".

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

"Not applicable"

REFERENCE TO A MICROFICHE APPENDIX

"Not applicable"

BACKGROUND OF THE INVENTION

1-Field of the Invention:

The present invention relates to video ~~projector technologies~~ projectors and, more particularly, to a video projector that adjusts automatically the projection brightness, color saturation, contrast and focus.

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2-Description of the related art:

~~Before using a video projector, it is necessary to set its focus, lightness, contrast and color saturation. These settings are made easy when the projection room and screen are designed adequatly. When the video projector and the screen are fixed, these adjustments are usually made one (at the installation).~~

~~With portable video projectors, projection conditions (room darkness, quality of the projection screen, projection distance,...) may vary from a presentation to an other. The user has to adjust his device (the projector) in order to optimize the projection quality: he has to set the focus according to the available projection distance and the screen size and he has to adjust the brightness, the contrast and the color saturation depending on the projection room and screen.~~

~~The disadvantage of portable video projectors is the necessity of the setting phase prior to every new projection, when the projection conditions are changed.~~

Before using a video projector, the user has to set the projector brightness, the color saturation, the contrast and the focus in order to have a good quality for the video presentation or video projected show. These different settings depend on the room conditions (lighting, quality of the projection screen, distance to the projection screen...) and they may vary from a video presentation to an other especially with portable video projectors.

Currently, some video projectors are equipped, on their top, with light sensors measuring the room lighting in order to calibrate the projection brightness accordingly. This method allows approximating the right brightness, to project with.

The light sensor, on the top of the projector, can be easily corrupted in specific conditions: a local light beam, on the sensor, will make the projection too bright and a projection screen brighter than the room will make the projection not bright enough and this will lead in both cases to a mismatch between the projection brightness and the room lighting.

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As far as the color saturation, the contrast setting and the focus are concerned, there is, currently, no video projector adjusting them automatically: All these settings are made by the user.

BRIEF SUMMARY OF THE INVENTION

~~The principal of this invention is to make the video projector adjustments (focus, brightness, contrast and color saturation) automated. The video projector will be able to detect the projection conditions (distance to the screen, screen quality, room darkness,...) and to set the optimal setting parameters in order to allow the best quality of projection in those conditions.~~

~~The projection conditions will be quantified by the mean of a detecting device (CCD camera for example) integrated to the video projector.~~

In accordance with the present invention, there is provided a video projector equipped with a sensor assembly made of video cameras and with a processor. The sensor assembly allows capturing the projection surface and the processor computes and sets automatically the optimum projection parameters. Depending on the room lighting, the projection distance and the quality of the projection screen, the video projector will set the brightness, the color saturation, the contrast and the focus.

It is therefore an object of the invention to provide a video projector with automated brightness setting.

It is another object of the invention to provide a video projector with automated color saturation setting.

It is another object of the invention to provide a video projector with automated contrast setting.

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It is another object of the invention to provide a video projector with automated focus setting.

BRIEF DESCRIPTION OF DRAWINGS

~~FIG.1 illustrates the principle of the Auto-Adjustment Video Projector: a capture device (CCD camera) allows to read the projection screen conditions in order to set automatically the projector.~~

A complete understanding of the present invention may be obtained by reference to the accompanying drawings, when considered in conjunction with the subsequent, detailed description, in which:

Figure 1 is a top view of a video projector, the projection area and the capture assembly in accordance with the invention; and

Figure 2 is an exploded view of an automated video projector with processor functions and the different signals from the processor and the capture assembly controlling the light modulator and the projection lens.

For purposes of clarity and brevity, like elements and components will bear the same designations and numbering throughout the FIGURES.

DETAILED DESCRIPTION OF THE INVENTION

~~Video projector will be equipped with a video camera that shoots back the projection screen (during an initialization phase). The video image of the screen will be interpreted to extract the informations describing the screen conditions, the projection distance and the room conditions (darkness and noise light).~~

~~These condition informations will be used to set the different adjustment parameters (focus, brightness, contrast and color saturation):~~

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~~Auto-focus:~~

~~In addition to the capture system (CCD video camera), the video projector will be equipped by a motorized projection lens. The auto-focus system (Hardware system integrated to the video projector) controls the motorized projection lens in order to obtain the best possible setting. A feed back loop composed by the capture device (CCD camera), the auto-focus Hardware and the motorized projection lens operates to converge to the optimal focus value.~~

~~The projector sends to the projection screen a sequence of test signal (lines, circles, or others…). The capture device (CCD camera) reads back these test signals and sends their video signal to the auto focus system to process them and command the motorized projection lens accordingly. The best focus setting is obtained when the projected image (of test signals) is closer to the received screen (received by the capture device : CCD camera).~~

~~Auto-Brightness:~~

~~The capture device in the video projector scans the projection screen and analyses its reflection characteristics in order to set the right brightness. Also the ambient noise light (the room light) is measured and involved in the computation of the brightness parameters. The control of the brightness can be made pixel by pixel. Psycho visual considerations are involved in the amlgorithm.~~

~~Auto-contrast:~~

~~The captured screen informations are used to determine the optimum contrast value to apply so that the viewers get the finest quality of projection for any particular conditions. The control of the contrast can be made pixel by pixel.~~

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~~Auto-color saturation:~~

~~The projection screen may not be always perfectly neutral: some parasite colored reflections (colored windows or door glass, reflection on colored wall...) can give the screen a tint of some color. The presentation will be affected and the screen stain will distress the audience. Although the human eyes restore this effect (after the beginning of the presentation), it still worthwile to recover the screen from the video projector by neutralizing the noise lights on it. This will release the viewer eyes and make them more comfortable. The control of the color saturation is made pixel by pixel.~~

Figure 1 is a top view of the video projector 101, the projection screen 100 and the capture assembly 106. The video projector 101 includes the projection lens 103 projecting video frames on the projection screen 100 and has a video interface 102 where the video signals to project are connected.

The video projector 101 includes also the capture assembly 106 made of one or two video cameras 104 and 106. The capture assembly 106 is placed in the front side of the video projector 101 in order to capture the projection screen 100.

Figure 2 is an exploded view of the automated setting video projector. It shows the processor 200 with the Software block 'Auto Optical Functions' 202 and the Software block 'Auto Imaging Functions' 203. The processor 200 controls the projection lens 103 through the control signal 204 and controls the light modulator 201 through the control signal 205.

The processor 200 is connected to the capture assembly 106 through the data bus 206 carrying digital video signals from the single camera or the pair of cameras of the said capture assembly 106.

It is provided in this invention a video projector having the capability of adjusting automatically the optical settings (Focus) and the imaging settings (Brightness, Contrast and Color saturation). An input video signal connected to the video projector 101 through the video input interface 102 is modulated to light in the light modulator 201 and projected on the projection screen 100 through the projection lens 103.

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The capture assembly 106, made of one or two cameras, generates capture video frames representing the projection scene and more particularly the projection screen 100. The said capture video frames are directed to the processor 200 to be analyzed and where the updated settings (Focus 202) and (Brightness, Contrast and Color saturation 204) are computed.

The Focus setting is computed proportionally to the measured distance between the projector and the projection screen 100. Processor 200 can easily compute the said distance from the capture video frames generated by the capture assembly 106. The appropriate Focus setting is transferred to the motorized projection lens 103 through the control signal 204.

During an initialization phase, the processor 200 uses the brightness of the capture video frames to update and compute the best projection brightness to be used. The processor 200 sends the updated value of brightness to the light modulator 201 through the control signal 205.

The capture video frames contrast is analyzed in the processor 200, to adjust the projection contrast. The processor 200 sends the updated value of the contrast to the light modulator 201 through the control signal 205.

The color saturation of the capture video frames is measured and the processor 200 adjusts the projection color saturations. The processor 200 sends the updated values of color saturation to the light modulator 201 through the control signal 205.

Advantages of the methods and systems described and claimed are the automation of the optical and imaging settings for video projectors and the comfort for users. The embedded capture assembly 106 and the processor 200 will both allow controlling the motorized projection lens 103 to adjust the focus and the light modulator 201 to set the projection brightness, contrast and color saturation.

Since other modifications and changes varied to fit particular operating requirements and environments will be apparent to those skilled in the art, the invention is not considered limited to the example chosen for purposes of disclosure, and covers all changes and modifications which do not constitute departures from the true spirit and scope of this invention.

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